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COAL MINING BRANCH
STANDARDIZATION DIVISION
AMERICAN MINING CONGRESS

Report of Co

on

Outside Coal Handling Equipment

HENRY MACE PAYNE, Chairman

October, 1922

REPORT OF THE OUTSIDE COAL HANDLING EQUIPMENT COMMITTEE, STANDARDIZATION DIVISION AMERICAN MINING CONGRESS

October, 1922

To the Standardization Committee, American Mining Congress:

The work of this Committee has been devoted during the past year to the following subjects:

1. Standard specifications for wire rope.
2. Standard specifications for splicing wire ropes.
3. Standard specifications for wire rope lubrication.
4. Standardization of supporting sheaves and rollers on rope hauls.
5. Standard system of signals for hoisting and lowering.
6. Standardization requirements for devices used in hauling men on inclines.
7. Standardization of practice in safety methods.
8. Standard sizes for shafting and pedestals.
9. Standard belt and gear sizes in connection with drives for tipple machinery.
10. Standard sizes for screens, with special reference to anthracite sizes.
11. Standardization of head sheaves for each size of rope, with particular reference to width of hub, size of shaft and diameter of wheel.
12. Standardization of pulley end shafting on stationary and hoist motors.
13. Standardization of hose threads on fire hydrants and outside fire connections.
14. Standard specifications for cotton rubber lined hose for private fire equipment.

Upon such items as are presented without comment, the Committee are unanimously agreed. Where difference of opinion exists, a summary of the views presented has been subtended.

1. STANDARD SPECIFICATIONS FOR WIRE ROPE.

The Committee has had under consideration (1) "Standard and

General Specifications for Wire Rope," adopted by the Canadian Engineering Standard Association, (2) Technologic Paper No. 121 on "Strength and other Properties of Wire Rope" by the U. S. Bureau of Standards, and (3) "Navy Department Specifications for Wire Rope" C&R No. 9470-A61, which latter we understand are shortly to be revised.

It appears that the Canadian Standards are not wholly adaptable to practice in the United States, as Canadian Standards of tensile strength are below those which we require.

It is recommended:

(1) That recognized grades for material for wire used in standard ropes shall be of

(a) acid or basic open-hearth or Bessemer steel of medium carbon content.

(b) plough steel.

(c) special plough steel.

(b) and (c) referring to high grade acid open-hearth steel 0.50 carbon content and upward, and of greater tensile strength than (a).

(2) The three grades shall be such that wire made from them will meet the requirements of the U. S. Navy Department for tensile strength.

(3) The central core of the rope, unless of wire, and the core of the several strands, if used, shall be of Manila or New Zealand hemp, jute cores not to be accepted. These cores to be thoroughly impregnated during the manufacture of the rope, with a preservative mixture which will have no injurious effect on the wires or the material of the cores.

(4) The whole rope while being laid up shall be thoroughly impregnated with a suitable lubricating compound which shall have no injurious effect on the component materials, shall not gum, and shall be of the proper consistency to be retained in the interstices of the strands of rope.

(5) When the rope is purchased by weight the purchaser shall be satisfied that no excess preservative or lubricant has been used.

(6) If galvanized, the galvanizing shall consist of a continuous coating of pure zinc of uniform thickness, which shall adhere to the wire and shall present a smooth surface.

(7) The diameter of the rope when delivered as measured over the outside wires, shall in no case be less than the nominal

sizes, and shall not exceed the same by more than 3-32″ in the case of rope 1″ diameter or larger, or by more than $\frac{1}{16}$″ in ropes less than 1″ diameter.

(8) The wire shall be of smooth,uniform finish and free from scales, flaws and inequalities.

(9) The completed rope shall be free from injurious defects, evenly laid, and free from kinks, loose wires, open strands, or other irregularities, and shall remain in this condition when unwound, provided proper precautions are taken and the ends secured.

(10) All rope shall be furnished on reels unless otherwise specified and shall be suitably protected against damage in transit.

2. WIRE ROPE SPLICING

In the matter of splicing wire ropes, the Committee recommends the following lengths of splices for different diameters of rope:

For	½	inch	rope	not	less	than	20	feet
"	⅝	"	"	"	"	"	25	"
"	¾	"	"	"	"	"	30	"
"	⅞	"	"	"	"	"	35	"
"	1	"	"	"	"	"	40	"
"	1⅛	"	"	"	"	"	45	"
"	1¼	"	"	"	"	"	50	"
"	1⅜	"	"	"	"	"	55	"
"	1½	"	"	"	"	"	60	"

3. STANDARD REQUIREMENTS FOR WIRE ROPE LUBRICATION.

It is recommended that:

(1) Wire rope lubricant should be a straight mineral petroleum product, free from acid.

(2) It should remain soft and pliable under all atmospheric conditions.

(3) It must not be subject to evaporation.

(4) It must be impervious to water and especially so when the water is heavily charged with acid peculiar to mining operations.

(5) It must not have water in its composition, nor absorb moisture.

(6) It must be of such nature that it will penetrate between the

strands to the core of the rope. Merely covering the rope with a filler does not lubricate it and only tends to hold the moisture in, if any has penetrated the rope between applications of lubricant.

(7) It must not decompose under the most severe conditions of service.

(8) It should possess such adhesive qualities as to not be thrown off by vibration or rapid motion.

(9) It must not harden, crack, chip or peel under low temperature conditions, or drip off the rope when subjected to heat.

(10) The quality should be such as to permit heating to a liquid consistency for ease of application.

It is considered by the Committee that safety will always be secured in adopting the recommended lubricant of the manufacturer of the rope in use.

4. STANDARDIZATION OF SUPPORTING SHEAVES AND ROLLERS ON ROPE HAULS.

In the matter of carrying rollers for wire ropes employed in mine haulage operations, it is recommended that rollers be spaced at distances dependent upon the work imposed upon them, but in no case farther apart than 100 ft.; that for light duty, rollers be constructed of gum or cottonwood, of a minimum diameter of 6″, running in heavy bearings so designed as to be readily and effectively lubricated; that for heavy duty, rope rollers be constructed of hollow iron or steel, softer than the material composing the rope; that their minimum diameter wherever possible be 8″, and that they be equipped with shafts of a diameter not less than 1¼″, with heavy bearings so designed as to be readily and efficiently lubricated.

It is further recommended that the width of face of all rope rollers be as great as the gauge of the track will permit, due clearance being maintained to permit the passage of the car wheel flanges.

Discussion: In a straight track, the rope will tend to stay in the middle and on curved slopes it is the custom to install turn sheaves, so as to keep the rope within a definite path.

Narrow rollers are so much cheaper that there is less tendency to use them after they have become badly worn, and the supports for the rollers may be so set that they will bring the different parts of the roller into a wearing position, so that after

a roller has become scored in one place in one set of supports, it can be moved to the next set of supports and a new wearing surface be presented.

In an exceptionally well aligned and maintained slope where very rapid hoisting is in practice, a built-up roller consisting of metal flanges and rubber or other soft throats have proven very satisfactory.

In opposition to this view, it is found that with inequalities which occur in tram tracks due to unequal settlement, the rope does not always land in the middle after a trip has passed. In a large majority of mines, tram tracks do not receive the attention they deserve and oftentimes as long as a trip will pass over them, no attention is given toward relining and resurfacing. In such cases as long a roller as possible, providing it is not too heavy, will catch and carry the rope where a shorter one would not.

5. STANDARD SYSTEM OF SIGNALS FOR HOISTING AND LOWERING.

SIGNALS FROM SHAFT TO ENGINEER:

1 Bell —Hoist; or stop if hoist is in motion.

2 Bells—Lower.

3 Bells—Men to be hoisted. (If men can be hoisted, the engineer signals to the cager with one bell. The cager then admits the men to the cage, and the signal to hoist, one bell, is given.)

4 Bells—Hoist slowly—danger.

5 Bells—Accident in mine; send down stretcher.

SIGNALS FROM ENGINEER TO SHAFT:

1 Bell —Men can get on cage.

6 Bells—Send up empty cage.

This code should be strictly followed at all mines. Additional signals as may be required may be arranged by the mine officials with the approval of the mine inspector. Such additional signals must be incorporated in the list posted at landings and in the engine room.

6. STANDARDIZATION REQUIREMENTS FOR DEVICES USED IN HAULING MEN ON INCLINES.

In addition to Recommendation No. 1, in this Committee's Report for 1921;

It is recommended that on all inclines where men are hoisted or lowered, or where it may be desired to do so, some one of the three following types of equipment, now recognized as approved, shall be installed:

(1) Safety devices engaging the road bed of the slope, or timber guides or runners laid parallel with the rails either below or at the side of the car or skip.

(2) Safety devices which engage the rail (and which in the opinion of the Committee are subject to criticism because of the possibility of their being wrecked when coming in contact with fish plates).

(3) Safety devices, similar to the Procktor System, which engage one or more stationary ropes.

Such installations should be automatic in action, their operation shall be dependent on the action of speed governors connected with the axle of the skip or car, and also provided with hand control for use where bad track or an obstruction would necessitate stopping the skip or car at some point on the slope.

The governors should be positively set to operate when the allowable safe speed is exceeded. The allowable safe speed for each slope shall be determined by the mine inspector but shall in no case exceed 1,000 feet per minute.

7. STANDARDIZATION OF PRACTICE IN SAFETY METHODS.

Construction Rules

Several general rules must be observed in building, placing, and using ladders.

1. The ladder should be of sufficient strength to safely resist double the strain of the heaviest load that will be placed upon it in use. This has been assumed to be about 450 pounds—the weight of a man and the burden he might reasonably be expected to carry up or down a ladder, and a like weight added as a margin of safety.

2. The ladder must be wide enough for the user to move freely and safely about his work.

3. *Clearances* (a) *In Back of Ladder:* A continuous clearance space should be provided, back of the ladder rungs. The depth of such a clearance should be sufficient to allow a person to obtain a fair purchase on the rung, as a slight obstruction to the foot or hand in gaining a hold on a rung may cause a misstep, with serious results.

For this reason, general practice favors a minimum clearance of 6½ inches, and some companies even favor allowing a minimum of 12 inches.

(b) *In Front of Ladder:* A continuous clearance space should be provided in front of the ladder so as not to compel a person to assume a cramped or unnatural posture in climbing. Fixed objects projecting at random too close to the front of a ladder may strike and injure the person climbing it, and such a blow may even be so severe as to cause a fall. Such projections are also a hazard, in that they may catch the clothing of the climber and jerk him loose from his hold. To eliminate such a hazard, some requirements provide for a minimum clearance space of 24 inches, but 30 inches to 36 inches seems to be more generally favored, and would undoubtedly be safer, because a workman often carries tools projecting from his pockets or tool belt that would not pass a 24-inch clearance.

(c) *Side of Ladder:* It is evident from the foregoing discussion that it is just as essential to have a proper continuous clearance space on each side of the ladder. Generally, conditions would be satisfied with a 15-inch continuous clearance space on each side of the center line of the ladder.

4. One man on one ladder at one time. If ladders are used as a common passageway, provide one (or a group) for ascending and one for descending, if of a permanent character.

SAFETY STANDARD COVERING LADDERS FOR GENERAL USE

Caution: Employees shall not remove or make ineffective any safeguards while the same are in use, except for the purpose of making repairs, and such safeguards so removed shall be replaced.

DEFINITIONS:

The term "Fixed Ladder" as used in these standards shall mean a ladder that is substantially fastened to a structure in a fixed position.

The term "Portable Ladder" as used in these standards shall mean a ladder with but one section that is used transiently at various locations.

The term "Extension Ladder" as used in these standards shall mean a ladder consisting of two or more parallel sections traveling in guides or brackets so arranged that it may be adjusted to variable lengths.

The term "Portable Step Ladder" as used in these standards shall mean a ladder so constructed as to be self-supporting.

The term "Fire Ladders" as used in these regulations shall mean a ladder used exclusively for fire purposes.

The term "Trolley Ladder" as used in these standards shall mean a ladder the movement of which is confined in permanent guides or ways at top or bottom, or both.

The term "Sectional Ladder" as used in these standards shall mean a ladder consisting of two or more sections so constructed that the sections will pyramid into each other.

The term "A" ladder as used in these standards shall mean a ladder of two parts of equal length, each equivalent to a straight ladder connected at the top by a hinged joint so as to be self-supporting when opened.

The term "Mine Shaft Ladder" as used in these standards shall mean a fixed ladder used in a mine ladderway, to provide means of ingress and egress from the lowest workings of the mine to the surface.

The term "Ladderway" shall mean a compartment separated from the hoisting compartments, the ladderway to be used only as a means of ingress and egress from the lowest workings or intermediate of the mine to the surface. Not for delivering tools to underground or working face.

The term "Cleated Ladder" as used in these standards shall mean a ladder that is made of small cross pieces of wood nailed to two planks to form a ladder. Not an approved type of ladder.

The term "Rung" as used in these standards shall mean a round or octagonal shape step or cross-bar of a ladder. An approved type of ladder step.

The term "Safety Cage or Well" as used in these standards shall mean a safety cage or well made of a series of parallel bars arranged so as to enclose anyone using a ladder in a safety cage or well.

SECTION 1—GENERAL:

(a) Where stairways are not provided, fixed ladders should preferably be used for access to elevated positions; where fixed ladders are not suitable, portable ladders should be used.

(b) Ladders shall be numbered, or otherwise designated, and regular inspections shall be made of their condition.

(c) The use of broken or weak ladders, or ladders with missing rungs is prohibited.

(d) When defects develop to such an extent that the ladder is to be permanently discarded, it shall be destroyed.

(e) Side rails, where wood is used, shall be straight-grained. Knots one-half inch (½″) or less in diameter will be permitted when they are in the center of the rails. The following woods should be used: Northern spruce, Oregon pine, Norway pine, or yellow pine.

(f) Rungs shall be inserted in holes in the side rails and kept from turning.

(g) Rungs, where wood is used, shall be straight-grained, and the following woods should be used: White ash, second growth, absolutely free from knots; oak, second growth, or hickory.

(h) Steps, where wood is used, should be constructed of the following woods: Northern spruce, Oregon pine, Norway pine or oak.

(i) Ladders constructed after the adoption of these standards shall have a uniform step and rung spacing of twelve inches (12″) on centers, except Masons ladders which should have a uniform rung spacing of 10″ on centers.

(j) Ladders having a variation of one-half inch (½″) or more in step or rung spacing shall be rebuilt to meet the requirements of Section 1, paragraph (1). Ladders constructed prior to the adoption of these standards having a uniform step and rung spacing of not less than ten inches (10″) nor more than fourteen inches (14″) on centers may be used.

(k) Ladders shall be equipped with approved devices designed to prevent slipping, see page 000 (Fixed ladders and portable step ladders excepted).

SECTION 2—FIXED LADDERS:

(a) Ladders having side rails are preferred to the type made of separate "U" shaped rungs embedded in wall or fastened to stack, etc.

(b) Pitch of ladders shall not be such that a man's position is necessarily below the ladder when climbing.

(c) Side rails, where metal is used, shall be not less than three-quarters of a square inch in cross-section. A size of two inches (2″) by three-eighths inch (⅜″) should be used. Where wood is used, they shall not be less than six (6) square inches in cross-section and shall be dressed on all sides, and all corners chamfered sufficiently to eliminate splinters.

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(d) Splice plates, where metal is used, shall be the same size as material for side rails and shall be double riveted or bolted. Bolts or rivets shall be countersunk on inside and shall be not less than one-half inch (½″) nor more than five-eighths inch (⅝″) in diameter, where cross-section does not exceed that of two inches (2″) by three-eighths inch (⅜″). Where wood is used there shall be splices, preferably of metal, on outside of side rails and joints shall be double riveted or bolted. Bolts or rivets shall be countersunk on inside. All splice pieces shall be chamfered at end.

(e) Rungs should be round. Where solid metal is used, they shall not be less than three-quarters inch (¾″) in diameter; where pipe is used, they shall be not less than one inch pipe; where wood is used, they shall not be less than one and one-half inches (1½″) in diameter at the center and the tenon shall be at least one inch in diameter or its equivalent in strength, and shall have a shoulder at least ⅛″ higher.

(f) Distance from front of rung to nearest permanent object back of the ladder shall be not less than six and one-half inches (6½″). No obstructions shall be less than thirty inches (30″) in front of the rungs nearest the man climbing the ladder. There shall be a clear width of at least fifteen inches (15″) from center on either side across the front of the ladder. (Ladders equipped with wells (cages) or their equivalent shall be excepted.)

(g) Ladders over fifteen feet (15′) in length should be provided with wells, unless the ladder is built in zigzag sections provided with platforms between sections.

(h) Safety cages or wells shall be placed on ladders 15 feet in height, the safety cage or well to consist of a series of parallel bars arranged so as to enclose anyone using the ladder in a cage or well.

(i) This cage or well to be approximately 27 inches inside diameter.

(j) Where the length of ladder is over 15 feet it is well to divide the ladder in sections, off-setting each section and constructing a railed landing between sections. This limits the distance a man could fall in case an accident should occur.

(k) The members of the cage or well, except conflicting with entrance space should be continued to the ground wherever practical, and fastened to the floor or foundation. Where ladders are located

in passageways or in places where this would encroach on the floor space, the bottom section may be omitted to a height of 7 feet from the ground.

(l) Fastenings shall be made of material equivalent in strength to the rails. Fastenings shall be made to wall by building in, by through bolts or expansion bolts grouted or leaded. The maximum vertical distance between fastenings or braces shall not be in excess of twelve inches (12″).

(m) Ladders to landing shall extend a distance of at least forty-five inches (45″) above the landing, preferably being goose-necked. The rungs may be omitted above the roof. Where a man must step a greater distance than eighteen inches (18″) from ladder to roof, tank, etc., a platform shall be provided.

(o) Where smokestacks are equipped with fixed ladders, they shall be of the cage type of construction. The rungs shall not be attached to the stack if brick or concrete, but to side pieces which shall be attached to the stack and providing at least eight inches clearance between stack and rung.

SECTION 3. PORTABLE STRAIGHT LADDERS

(a) Ladders over thirty feet (30′) in length should not be used.

(b) Side rails shall have a minimum cross-section equivalent in strength to a Northern spruce side rail of the following dimensions:

Up to and including 10′, 2⅜″ x 1⅜″.
Over 10′ up to and including 18′, 2¾″ x 1⅜″.
Over 18′ up to and including 26′, 3″ x 1⅝″.
Over 26′ up to and including 30′, 3½″ x 1⅞″.

(c) Side rails should spread so that the width of the ladder at the bottom will be greater than the width at the top, preferably by a taper of one-quarter (¼″) per foot of length.

(d) Rungs shall be equivalent in strength and wear to an ash rung of the following dimensions:

	Diameter	Tenon
Up to and including 24″	1¼″	⅞″
Over 24″ up to and including 30″	1⅜″	⅞″

(e) All portable ladders shall be fitted with nonslip feet or hooks.

SECTION 4. EXTENSION LADDERS:

(a) The construction, use and maintenance of extension

ladders shall conform to the specifications herein set forth covering portable straight ladders. (Section 3, paragraphs (a) and (c) excepted).

(b) Ladders shall be equipped with approved safety locks.

(c) All portable ladders shall be fitted with nonslip feet or hooks.

SECTION 5. FIRE LADDERS:

(a) The construction, use and maintenance of industrial fire ladders shall conform to the specifications herein set forth covering portable straight ladders. (Section 3, paragraph (a) excepted.)

(b) Fire ladders shall be plainly marked "For Fire Purposes Only."

(c) Fire Ladders shall not be used for any other purpose than that for which they are intended.

(d) All portable ladders shall be fitted with non-slip feet or hooks.

SECTION 6. PORTABLE STEP LADDERS:

(a) Ladders over twenty feet (20′) in length shall not be used.

(b) Side rails shall have a minimum cross-section equivalent in strength and wear to a Northern spruce side rail of the following dimensions:

Up to and including 12′, $\frac{7}{8}$″ x 3″.

Over 12′ up to and including 16′, 1″ x $3\frac{1}{2}$″.

Over 16′ up to and including 20′, 1″ x 4″.

(c) Front and back rails shall be so spread when the ladder is open that the width at the bottom, inside to inside, shall be greater than the width at the top, inside to inside, by an amount equal to or greater than one and one-half inches ($1\frac{1}{2}$″) per foot of length of ladder. Minimum width between side rails at the top step, inside to inside, shall be not less than twelve inches (12″) with a taper of at least one inch (1″) per foot of length of ladder.

(d) Steps shall be equivalent in strength and wear to a Northern spruce step of the following dimensions:

Up to and including 12′, $\frac{3}{4}$″ x $4\frac{1}{4}$″.

Over 12′ up to and including 16′, $\frac{7}{8}$″ x $4\frac{1}{4}$″.

Over 16′ up to and including 20′, 1″ x $4\frac{1}{2}$″.

(e) Steps shall be trussed and screwed, bolted or riveted to the side of rails. Nails shall not be used as sole fastenings.

SECTION 7. "A" LADDERS:

(a) Ladders over twenty feet (20′) in length should not be used.

(b) Side rails shall have a minimum cross section equivalent in strength and wear to a Northern spruce side rail of the following dimensions:

Up to and including 12′, 1¼″ x 2¾″.

Over 12′ up to and including 16′, 1½″ x 3″.

Over 16′ up to and including 20′, 1½″ x 3½″.

(c) Side rails should be so spread that the width of the ladder at the bottom, inside to inside, is greater than the width at the top inside to inside, by an amount equal to or greater than one and one-half inches (1½″) per foot of length of ladder.

(d) Bearings shall be equivalent in strength and wear to an ash bearing one inch (1″) by two inches (2″). Bearings shall be straight-grained and absolutely free from knots; they shall be mortised through sides and have a tenon not less than five-eighths of an inch by two inches (⅝″ x 2″), secured to side with wire nail. The bearing shall be three inches (3″) from the top of the side rail. Bearings shall be eighteen inches (18″) on centers, and shall be staggered. Top of side rails shall be cut on bevel to stop same from spreading. Hinges shall be wrought or malleable iron, bolted or riveted to side rails.

SECTION 8. TROLLEY LADDERS:

(a) Ladders shall be suspended from tracks fastened securely to the ceiling or to the framework with which the ladders are connected. Tracks should be wrought iron or wood. Tracks shall be constructed so that it is impossible for the wheels to jump the track, by having the wheels in pairs situated on opposite sides of a vertical flange or by having the track so shaped that it completely encloses the sides of the wheels. Each ladder shall have at least four wheels making contact with the track. The extreme front and back wheels shall have a horizontal distance of at least eight inches (8″) between their centers.

(b) The track wheels shall be rigidly fastened to the top of the ladder with suitable steel or wrought iron brackets. These brackets may be fastened to a bolt connecting the two side rails of the ladder or to the top step. In the latter case the top step shall be provided with extra metal braces to the side rails.

(c) Side rails shall have a minimum spread, inside to inside, of ten inches (10″).

(d) Side rails shall have a minimum cross-section equivalent in strength and wear to a Northern spruce side rail four inches (4″) by seven-eighths inch (⅞″).

(e) Steps shall be equivalent in strength and wear to a Northern spruce step four and three-quarters inches (4¾″) by three-quarter inch (¾″).

(f) Steps, where metal is used shall be flanged downward not less than two inches (2″) at both ends and secured by two bolts or rivets to each side rail. Where wood is used, they shall be inset in the side rails one-quarter inch (¼″) glued and nailed; all, or at least alternate steps shall be braced to the side rails with metal brackets placed under the step.

(g) The base of the ladder shall rest on two wheels or castors. They shall be placed on the outside of the side rails; except that where space is restricted, they may be placed on the inner side of the side rail.

STANDARDS COVERING
Mine Ladders and Ladderways.

SECTION 10. LADDERS AND LADDERWAYS:

It shall be the duty of the operator of every mine to provide in addition to any mechanical means of ingress and egress, at least one means of outlet for miners by means of ladders from the lowest working of the mine to the surface. Except in the case of swinging or extension ladders used for shaft sinking, all ladders and ladderways constructed after the adoption of these standards shall be built as prescribed in the following standard rules:

(a) The rungs of ladders shall be round and provided with shoulders to take spreader action. Where solid metal is used, they shall be not less than three-quarters inch (¾″) in diameter; where pipe is used, they shall be not less than one and one-fourth inches (1¼″) in diameter or its equivalent in strength.

(b) Where cleated ladders have been constructed prior to the adoption of these standards, the cleat shall be reinforced with a binder strip.

(c) The distance between the centers of the rungs of a ladder shall not exceed twelve inches and shall not vary more than one-half

inch in any one ladderway. The lengths of the ladder rungs (width of the ladder) shall not be less than twelve inches.

(d) The rungs of a ladder shall in no case be less than 6½ inches from the wall, shaft timbers, or other obstruction in the shaft or foothold.

(e) Every main ladderway with an inclination of more than seventy degrees from the horizontal, the distance between the top and bottom of which is more than fifty feet, shall have substantial platforms at intervals of not more than thirty feet, measured vertically. Where the inclination of any ladder or section of a ladder, in main ladderways, exceeds eighty degrees from the horizontal, the sections of the ladder shall be staggered at each platform so that no section shall be directly in line with the section above or below it.

(f) All such platforms, except for an opening large enough to permit the passage of a man, shall be closely covered and protected by railings.

(g) Ladders shall be extended at least four feet above the collar of the shaft, unless convenient and secure handholds are fixed at such places.

(h) In ladderways, other than main ladderways, not exceeding one hundred feet in depth or height, ladders may be fixed vertically. No vertical ladders shall be used with a greater height or depth than one hundred feet.

(i) Under no circumstances shall any ladder inclining backward from the vertical be installed.

(j) Ladderways shall be provided in all shafts steeper than sixty degrees from the horizontal in the course of sinking, to within such a distance from the bottom thereof as will secure them from damage by blasting. From the end of such ladderways, chain, wire rope or wooden extension ladders, or chains to reach to the bottom of the shaft shall be provided.

(k) All ladderways shall be separate from the hoistway compartments, either boarding them off completely or placing heavy wire screening on the aperture. Screening is preferred, except in wet shafts, as it interferes less with ventilation.

(l) Electric lights shall be installed throughout the length of the ladderway compartment of shafts away from the ladder side.

(m) Power wires shall be carefully boxed or carried down shaft in conduits and placed in one corner away from ladder side.

(n) Steam pipes in ladderways shall be covered and placed in one corner away from ladderway compartments.

(o) Under no circumstances shall ladderways be used for delivering tools to the underground or working face.

(p) All defects in ladderways shall be reported promptly to the proper one in charge, who shall have same repaired immediately. If it becomes necessary to remove a ladder from regular traveling way, the danger signals shall be posted above such open place until the ladder is replaced, or ladderway shall be closed until made safe for travel.

(q) Where exits from ladderway compartments are located close to the tipple they should be completely covered with iron roof at an angle of about 50 degrees to protect men from falling objects while entering or leaving the ladderway.

SECTION 11. STAIRS:

(a) Stairs shall be used if the grade is greater than 20 degrees and less than 50 degrees from the horizontal. For a grade less than 20 degrees an incline (ramp) is preferable; for grades over 50 degrees fixed ladders shall be used. Spiral stairways shall be avoided.

(b) All permanent stairways, balconies, runways, etc., should be completed as soon as possible during erection of the structure so that they may be utilized by construction forces instead of temporary ladders.

SECTION 12. DIMENSIONS OF STAIRS:

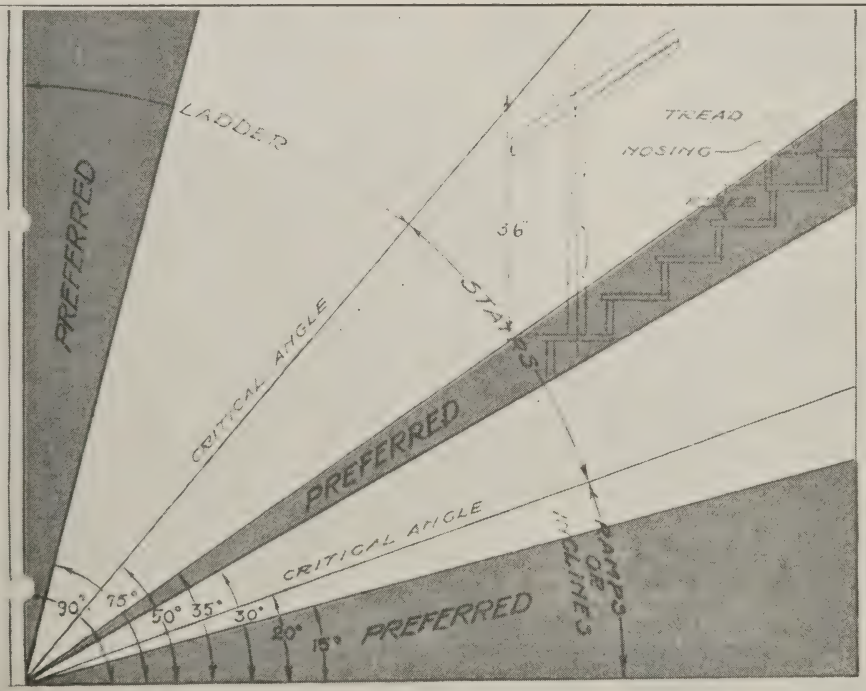
(a) Minimum width of stairways shall be 27 inches.

(b) The width of stairways shall be as great as is consistent with location and usage.

(c) The use of long flights is to be avoided by the provision of landings; width of landings to be proportioned to a multiple of the natural pace (approximately 25 inches).

SECTION 13. RISERS AND TREADS:

(a) All risers and treads in the flight of stairs shall be of uniform dimensions. Table in figure gives the recommended dimensions of risers and treads. The sum of twice the riser plus the tread should equal 25 inches.



STAIRS, LADDERS AND RAMPS OR INCLINES

TABLE OF RISERS AND TREADS FOR STAIRS
(TREAD + RISER = 17½")

ANGLE WITH HORIZONTAL	RISER IN INCHES	TREAD IN INCHES	
22°-00'	5	12½	
23°-14'	5¼	12¼	
24°-38'	5½	12	
26°-00'	5¾	11¾	
27°-33'	6	11½	
29°-03'	6¼	11¼	
30°-35'	6½	11	P.F.D.
32°-08'	6¾	10¾	
33°-41'	7	10½	
35°-16'	7¼	10¼	
36°-52'	7½	10	
38°-29'	7¾	9¾	
40°-08'	8	9½	
41°-44'	8¼	9¼	
43°-22'	8½	9	
45°-00'	8¾	8¾	
46°-38'	9	8½	
48°-16'	9¼	8¼	
49°-54'	9½	8	

(b) No tread shall be under-cut more than one-third its width.

(c) When the nosing of the tread is rounded, the radius shall not exceed $\frac{3}{8}$ inch.

(d) Open risers and slatted treads shall be avoided.

(e) Treads shall have non-slip surfaces.

SECTION 14. HANDRAILS FOR STAIRS:

(a) Handrails of 36 inches (measured vertically) above the center of the tread, with an intermediate rail between the top rail and treads, shall be provided on each flight of stairs as follows:

On all open sides.

On one side of enclosed stairways 4 feet or less in width; preferably on both sides.

On both sides of enclosed stairways 4 feet or over in width between rails.

On both sides and in center of stairways over 8 feet in width.

(b) All landings shall be provided with a 6-inch toe-board, or other enclosure in addition to rail.

8. STANDARD SIZES FOR (a) SHAFTING AND (b) PEDESTALS.

(a) The A. S. M. E., having already adopted a report, which up to 4" coincides with the consensus of opinion among manufacturers and dealers, that portion of the report is recommended as follows:

TRANSMISSION SHAFTING:

$\frac{15}{16}$ in., $1\frac{3}{16}$ in., $1\frac{7}{16}$ in., $1\frac{11}{16}$ in., $1\frac{15}{16}$ in.
$2\frac{3}{16}$ in., $2\frac{7}{16}$ in., $2\frac{15}{16}$ in., $3\frac{7}{16}$ in., $3\frac{15}{16}$ in.

Anything above 4 inches to be considered as special.

MACHINERY SHAFTING:

Up to $2\frac{1}{2}$ inches by sixteenths; from $2\frac{1}{2}$ in., to 4 in., inclusive, by eighths; from $4\frac{1}{4}$ in., to 6 in., by quarters.

The adoption of standard sizes of shafting will mean that in the future there will be a gradual elimination of odd sizes from makers' lists and from dealers' stocks, and for new construction only standard sizes would be selected.

(b) Many pedestals go on ceilings and many on floors. The size of the pedestal depends on the diameter of the pulleys, which in turn determines the drop of the hangers.

A single type of pattern would fill all the requirements of the trade. At present some bearings have lengths equal to twice the diameter, others two and one-half times the diameter. Pedestals and hangers also run in odd and even inches without reason. The widths of the base of the pedestals vary and the designing engineer must know what pedestal is to be used before he can indicate the supports on drawings.

Bearings could be made interchangeable by limiting dimensions of (1) length of back, (2) backing of bearing, (3) size, and (4) number and spacing of bolts. This would leave the general design of the bearings up to the manufacturer but would make them interchangeable without limiting him to set designs.

As regards 9 (b), the Committee suggests that this be carried over for consideration during the next year.

9. STANDARD BELT AND GEAR SIZES IN CONNECTION WITH DRIVES FOR TIPPLE MACHINERY.

DISCUSSION: Practically no two tipples are alike as to general arrangement. The screens vary in size, arrangement of machinery is different, some have chutes to cars, while others have picking tables with loading booms. The ideal arrangement is to put in individual motor drives on each unit.

In the majority of cases, the number of motors is cut down and each motor drives as many units as possible This directly affects the arrangement of driving machinery, belts, etc.

Many picking tables are operated with individual motors located directly at the drive shaft of the picking table, thus providing a very compact spur geared drive, easily inspected and enclosed with guards. Others are driven by extended shafts running completely across the tipple to the main motor locations.

In some of these cases, one motor drives the shaking screens, picking tables, refuse conveyors, etc.

Consideration must also be given to the fact that many operators specify speeds from 750 r. p. m. to 1800 r. p. m.

It is recommended that wherever possible, individual motor drives be located directly at the point of application of power to the unit, such as picking tables, screens, etc., thus eliminating shafting and belts running through the tipple. This would render all parts of the tipple around which men must work absolutely free from moving parts such as couplings, clutches, belts, pulleys, etc. When the

cost of supports, guards, rails, etc., is taken into consideration, the cost of individual mechanical equipment will not be found objectionable.

10. STANDARD SIZES FOR SCREENS, WITH SPECIAL REFERENCE TO ANTHRACITE SIZES.

This subject is being investigated by the A. S. M. E. It is therefore recommended that this item be carried over until the A. S. M. E. has completed its work.

11. STANDARDIZATION OF HEAD SHEAVES FOR EACH SIZE OF ROPE WITH PARTICULAR REFERENCE TO (a) WIDTH OF HUB, (b) SIZE OF SHAFT AND (c) DIAMETER OF WHEEL.

(a) and (b). The Committee has been unable to complete its work on these items, and proposes to carry them into the Agenda for 1923.

(c) It is recommended that in the purchase of either wire rope or sheaves, due reference be made to the standard tables of sizes published by the wire rope Manufacturers and summarized in current handbooks, and that only such combinations be made as many years' experience has indicated practicable in these reference tables.

12. STANDARDIZATION OF PULLEY END SHAFTING ON STATIONARY AND HOIST MOTORS.

The sizes of equipment of the leading Manufacturers are listed herewith, and the suggested sizes for standardization have been submitted to these companies for consideration.

The Committee after a careful canvas of the situation among many engineers using this equipment, recommends the adoption of the suggested sizes and urges upon the Manufacturers their co-operation in making these sizes standard.

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Report of Committee on outside coal handling equipment; Henry Mace Payne, chairman. October, 1922. [Washington?, 1922?]

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TABLE SHOWING SIZES OF PULLEY END SHAFTS OF STATIONARY INDUCTION MOTORS

H. P.	Make	R. P. M. (Syn. Speed)					Remarks
		1800	1200	900	720	600	
5	General Electric Co.	1 1/8	1 3/8	1 5/8	1 7/8	1 7/8	
	Westinghouse	1 1/4	1 5/8	1 5/8	1 7/8	1 7/8	
	Crocker Wheeler	1 1/4	1 1/2	1 3/4	2	2	
	Allis Chalmers	1 1/8	1 5/8	1 5/8	1 7/8	1 7/8	
	SUGGESTED SIZE	1 1/4	1 5/8	1 5/8	1 7/8	1 7/8	
7 1/2	General Electric Co.	1 5/8	1 5/8	1 7/8	1 7/8	2 1/8	
	Westinghouse	1 5/8	1 5/8	1 7/8	1 7/8	1 7/8	
	Crocker Wheeler	1 1/2	1 3/4	2	2	2 1/4	
	Allis Chalmers	1 5/8	1 5/8	1 7/8	1 7/8	1 7/8	
	SUGGESTED SIZE	1 5/8	1 5/8	1 7/8	1 7/8	2 1/8	
10	General Electric Co.	1 5/8	1 7/8	1 7/8	2 1/8	2 1/8	
	Westinghouse	1 5/8	1 7/8	1 7/8	1 7/8	2 3/8	
	Crocker Wheeler	1 3/4	2	2	2 1/4	2 1/4	
	Allis Chalmers	1 5/8	1 7/8	1 7/8	2 3/8	2 3/8	
	SUGGESTED SIZE	1 5/8	1 7/8	1 7/8	2 1/8	2 3/8	
15	General Electric Co.	1 5/8	1 5/8	1 7/8	2 1/8	2 3/8	
	Westinghouse	1 7/8	1 7/8	1 7/8	2 3/8	2 3/8	
	Crocker Wheeler	2	2	2 1/4	2 1/4	2 3/4	
	Allis Chalmers	1 7/8	1 7/8	2 3/8	2 3/8	2 3/8	
	SUGGESTED SIZE	1 7/8	1 7/8	2 1/8	2 3/8	2 3/8	
20	General Electric Co.	1 5/8	1 7/8	2 1/8	2 3/8	2 3/8	
	Westinghouse	1 7/8	1 7/8	2 3/8	2 3/8	2 7/8	
	Crocker Wheeler	2	2 1/4	2 1/4	2 3/4	2 3/4	
	Allis Chalmers	1 7/8	2 3/8	2 3/8	2 3/8	2 7/8	
	SUGGESTED SIZE	1 7/8	1 7/8	2 3/8	2 3/8	2 7/8	
25	General Electric Co.	1 5/8	2 1/8	2 1/8	2 5/8	2 5/8	
	Westinghouse	1 7/8	2 3/8	2 3/8	2 7/8	2 7/8	
	Crocker Wheeler	2 1/4	2 1/4	2 3/4	2 3/4	3	
	Allis Chalmers	1 7/8	2 3/8	2 3/8	2 7/8	2 7/8	
	SUGGESTED SIZE	1 7/8	2 3/8	2 3/8	2 7/8	2 7/8	
30	General Electric Co.	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	
	Westinghouse	1 7/8	2 3/8	2 3/8	2 7/8	2 7/8	
	Crocker Wheeler	2 1/4	2 3/4	2 3/4	3	3	
	Allis Chalmers	2 3/8	2 3/8	2 3/8	2 7/8	2 7/8	
	SUGGESTED SIZE	1 7/8	2 3/8	2 3/8	2 1/8	2 1/8	
40	General Electric Co.	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	
	Westinghouse	2 3/8	2 3/8	2 7/8	2 7/8	2 7/8	
	Crocker Wheeler	2 3/4	2 3/4	3	3	.....	
	Allis Chalmers	2 3/8	2 3/8	2 7/8	2 7/8	2 7/8	
	SUGGESTED SIZE	2 3/8	2 3/8	2 7/8	2 7/8	2 7/8	
50	General Electric Co.	2 1/8	2 5/8	2 7/8	3 1/8	3 3/8	
	Westinghouse	2 7/8	2 7/8	2 7/8	2 7/8	3 3/8	
	Crocker Wheeler	.....	3	3	3 1/2	.....	
	Allis Chalmers	2 3/8	2 7/8	2 7/8	2 7/8	2 7/8	
	SUGGESTED SIZE	2 3/8	2 7/8	2 7/8	2 7/8	3 3/8	
60	General Electric Co.	2 3/8	2 7/8	3 1/8	3 3/8	3 3/8	
	Westinghouse	2 7/8	2 7/8	2 7/8	2 7/8	3 3/8	
	Crocker Wheeler	.....	.....	.....	3 1/2	4	
	Allis Chalmers	2 7/8	2 7/8	2 7/8	2 7/8	.....	
	SUGGESTED SIZE	2 7/8	2 7/8	2 7/8	2 7/8	3 3/8	
75	General Electric Co.	.....	2 7/8	3 3/8	3 3/8	3 1/2	
	Westinghouse	2 7/8	2 7/8	3 3/8	3 3/8	3 7/8	
	Crocker Wheeler	.....	3	3 1/2	4	4	
	Allis Chalmers	2 7/8	2 7/8	2 7/8	.....	.....	
	SUGGESTED SIZE	2 7/8	2 7/8	3 3/8	3 3/8	3 7/8	
100	General Electric Co.	2 1/2	3 1/8	3 3/8	3 1/2	4	
	Westinghouse	2 7/8	3 3/8	3 3/8	3 1/8	3 7/8	
	Crocker Wheeler	.....	3 1/2	4	4	.....	
	Allis Chalmers	2 7/8	.....	.....	.....	.....	
	SUGGESTED SIZE	2 7/8	3 1/8	3 3/8	3 7/8	3 7/8	
150	General Electric Co.	2 1/2	.....	4	4 1/2	4 1/2	
	Westinghouse	3 3/8	3 7/8	4 3/8	4 3/8	4 3/8	
	Crocker Wheeler	.....	.....	.....	4 3/4	5 1/4	
	Allis Chalmers	2 7/8	.....	.....	.....	.....	
	SUGGESTED SIZE	3 1/8	3 3/8	3 7/8	4 3/8	4 3/8	
200	General Electric Co.	.....	.....	.....	4 1/2	4 1/2	
	Westinghouse	3 7/8	3 7/8	4 3/8	4 3/8	4 3/8	
	Crocker Wheeler	.....	.....	4 3/4	5 1/4	6	
	Allis Chalmers	2 7/8	.....	.....	.....	.....	
	SUGGESTED SIZE	3 7/8	3 7/8	4 3/8	4 3/8	4 3/8	

Note: Motors tabulated are continuous rated-3 Phase-60 cycle. 220-440-550 volt.

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13. STANDARDIZATION OF HOSE THREADS ON FIRE HYDRANTS AND OUTSIDE FIRE CONNECTIONS.

It is recommended that the standard sizes of hose and hose thread adopted by the National Board of Underwriters, the International Firemen's Conference and the National Fire Protection Association, be installed on all hydrants, standpipes and water line connections for fire protection, to facilitate outside aid in the event of large fires, and to provide ideal fits and insure uniform threads in ordering new and replacement fittings.

Briefly, these are $2\frac{1}{2}''$ hose, 60 deg. V-thread, outside diameter on the male thread $3\frac{1}{16}''$ and $7\frac{1}{2}$ threads per inch.

Where a hose thread differing from the standard is used by the local fire department an ample supply of matching pieces which will enable all different connections between the standard thread and the hose thread of the fire department, and between standpipe threads and the thread used by the Fire Department, shall be provided in an easily accessible place.

14. STANDARD SPECIFICATIONS FOR COTTON RUBBER LINED HOSE FOR PRIVATE FIRE EQUIPMENT.

It is recommended that the specifications of the A. S. T. M. "D14-21T" be adopted and made a part of this report.

These apply to $2\frac{1}{2}''$ hose for use in private fire departments and cover its manufacture, physical properties and tests, dimensions and weights, couplings, marking, and inspection or rejection.

HENRY MACE PAYNE, Chairman,
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